WHAT IS CLAIMED IS:

1. A system for creating a patterned polarization compensator comprising:

(a) a retardance characterization system for optically scanning the spatially variant retardance of a spatial light modulator; and

(b) a compensator patterning system for writing a spatially variant photo-alignment pattern on said polarization compensator.

2. A system for creating a patterned polarization compensator as in claim 1 further comprising:

(a1) applying a photo-alignment layer onto a substrate of said polarization compensator; and

(a2) applying a liquid crystal polymer layer onto said photo-alignment layer.

3. A system for creating a patterned polarization compensator as in claim 2 wherein a spatially variant retardance pattern is formed into said liquid crystal polymer layer.

4. A system for creating a patterned polarization compensator as in claim 3 wherein said liquid crystal polymer layer comprises liquid crystalline materials that include cross-linkable liquid crystalline monomers, oligomers, or pre-polymers, which are subsequently fixed by exposure to light in order to form said liquid crystal polymer layer.

5. A system for creating a patterned polarization compensator as in claim 4 wherein said light used for fixing the liquid crystalline materials is UV light.

6. A system for creating a patterned polarization compensator as in claim 4 wherein said light used for fixing the liquid crystalline materials is

visible and wherein said liquid crystalline materials are augmented with visible wavelength sensitive photo-initiators.

7. A system for creating a patterned polarization compensator according to claim 1 wherein said retardance characterization system comprises a visible light source that emits a light beam, at least one polarizer to control the polarization states of said light beam, a scanning mechanism to move said spatial light modulator and said light beam relative to each other, an optical detector for measuring changes in optical power, and a tunable compensator that both allows the orientation of said polarization states to be controlled and a retardance to be measured.

8. A system for creating a patterned polarization compensator according to claim 7 wherein said visible light source of said retardance characterization system is a laser.

9. A system for creating a patterned polarization compensator according to claim 7 wherein said light beam of said retardance characterization system is incident onto said spatial light modulator at non-normal incidence.

10. A system for creating a patterned polarization compensator according to claim 7 wherein a mirror is used in place of said spatial light modulator as part of a calibration process.

11. A system for creating a patterned polarization compensator according to claim 7 wherein said tunable compensator is a Soliel Babinet compensator or an ellipsometer.

12. A system for creating a patterned polarization compensator according to claim 7 wherein said polarizers are Glan-Taylor prisms.

13. A system for creating a patterned polarization compensator according to claim 7 wherein said scanning mechanism provides controlled motion of said spatial light modulator.

14. A system for creating a patterned polarization compensator according to claim 1 wherein said compensator patterning system comprises a light source that emits a light beam, at least one polarizer to control the polarization states of said light beam, a scanning mechanism to move a substrate for said patterned compensator and said light beam relative to each other, and a tunable compensator that both allows the orientation of said polarization states to be controlled in accordance with a desired retardance.

15. A system for creating a patterned polarization compensator according to claim 14 wherein said light source of said compensator patterning system is a UV light source.

16. A system for creating a patterned polarization compensator according to claim 14 wherein said light source of said compensator patterning system is a visible light source, and said photo-alignment layer is provided with visible wavelength sensitive photo-initiators.

17. A system for creating a patterned polarization compensator according to claim 14 wherein scanning mechanism of said compensator patterning system provides controlled motion of said substrate

18. A system for creating a patterned polarization compensator according to claim 14 wherein said light beam of said compensator patterning system is intensity modulated by a controlled rotation of at least one of said polarizers relative to another of said polarizers.

19. A system for creating a patterned polarization compensator according to claim 1 wherein said spatial light modulator is a reflective liquid crystal device.

20. A system for creating a patterned polarization compensator according to claim 1 wherein said spatially variant retardance patterned onto said compensator is created with said spatial light modulator operating at a mid-level between the on and off states of said modulator.

21. A system for creating a patterned polarization compensator wherein according to claim 1 wherein said retardance characterization system comprises a visible light source that emits a light beam, one or more polarizers to control the polarization states of said light beam, a scanning mechanism to move said spatial light modulator and said light beam relative to each other, an adjustable wave plate for controlling the orientation of said polarization states, and a polarimeter for measuring retardance.

22. A system for creating a patterned polarization compensator comprising:

(a) a retardance characterization system for optically scanning a spatially variant retardance of a spatial light modulator with a first light beam; and

(b) a compensator patterning system for optically writing a spatially variant pattern into a photo-sensitive material with a second light beam.

23. A system for creating a patterned polarization compensator as in claim 22 wherein a spatially variant optical retardance is formed that corresponds to said spatially variant pattern and which is stable under exposure to visible light.

24. A system for creating a patterned polarization compensator as in claim 23 wherein said photo-sensitive material is fabricated with an optical

film, wherein said spatially variant optical retardance is formed by a process of light absorption and material change at temperatures at or above a thermal transition point.

25. A system for creating a patterned polarization compensator according to claim 22 wherein said retardance characterization system comprises a visible light source that emits said first light beam, at least one polarizers to control the polarization states of said first light beam, a scanning mechanism to move said spatial light modulator and said first light beam relative to each other, an optical detector for measuring changes in optical power, and a tunable compensator that both allows the orientation of said polarization states to be controlled and a retardance to be measured.

26. A system for creating a patterned polarization compensator according to claim 22 wherein said compensator patterning system comprises a light source that emits said second light beam, at least one polarizer to control the polarization states of said second light beam, a scanning mechanism to move a substrate for said patterned compensator and said light beam relative to each other, and a tunable compensator that both allows the orientation of said polarization states to be controlled in accordance with a desired retardance.

27. A method for fabricating a spatially patterned polarization compensator comprising:

(a) scanning a spatial light modulator with a first light beam to measure a spatially variant retardance of said spatial light modulator;

(b) providing a polarization compensator substrate with a photo-sensitive alignment layer;

(c) scanning said polarization compensator substrate with a second light beam so as to form a spatially variant alignment pattern onto said photo-sensitive alignment layer;

(d) coating said polarization compensator substrate with a liquid crystalline material; and

(e) fixing said liquid crystal material to form a liquid crystal polymer layer.

28. A method according to claim 27 wherein said spatial light modulator is a reflective liquid crystal device.

29. A method for fabricating a spatially patterned polarization compensator comprising:

(a) optically scanning a spatial light modulator with a first light beam to measure a spatially variant retardance of said spatial light modulator;

(b) providing a photo-sensitive optical material capable of supporting a spatially patterned retardance;

(c) scanning said photo-sensitive optical material with a second light beam so as to form a spatially variant pattern onto said photo-sensitive optical material; and

(d) completing said spatially patterned polarization compensator to form a spatially variant optical retardance which corresponds to said spatially variant pattern and which is stable under exposure to visible light.

30. A system for creating a patterned polarization compensator comprising:

(a) a retardance characterization system for optically scanning the spatially variant retardance of a spatial light modulator;

(a1) applying a photo-alignment layer onto a substrate of said polarization compensator; and

(a2) applying a liquid crystal material layer onto said photo-alignment layer;

(b) a compensator patterning system for writing a spatially variant photo-alignment pattern on said polarization compensator; and

(b1) fixing said liquid crystal material layer, to form a liquid crystal polymer layer with a spatially variant

retardance pattern formed into the structure of said patterned polarization compensator.